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# Argus Green Ammonia Strategy Report

Table of Contents, key features and insightful extracts

A unique, essential report focused on the currently embryonic but potentially huge market for ammonia as a low or zero carbon energy carrier.

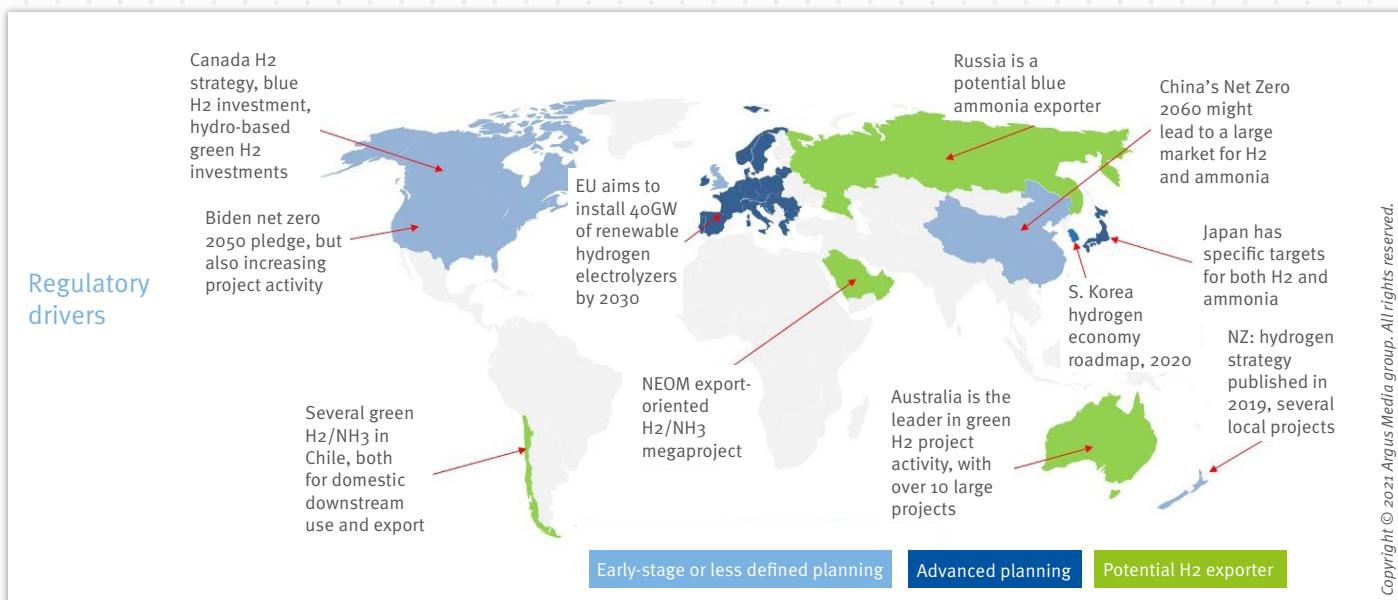


## Key market trends analysed

The projected volume and drivers of growth in the market for ammonia as a decarbonised energy carrier

Ammonia's position in the fuel mix in the new decarbonized fuel economy and sectors expected to adopt ammonia as a fuel

The factors likely to determine the development of low carbon ammonia capacity and locations likely to become key supply hubs



## Key questions addressed

Which sectors and end-uses is green ammonia best suited to?

How quickly will these markets develop and on what scale?

Will these markets develop without intervention, or will regulation be required?

What does the existing ammonia market look like, and how capable is it of adapting to this new end-use?

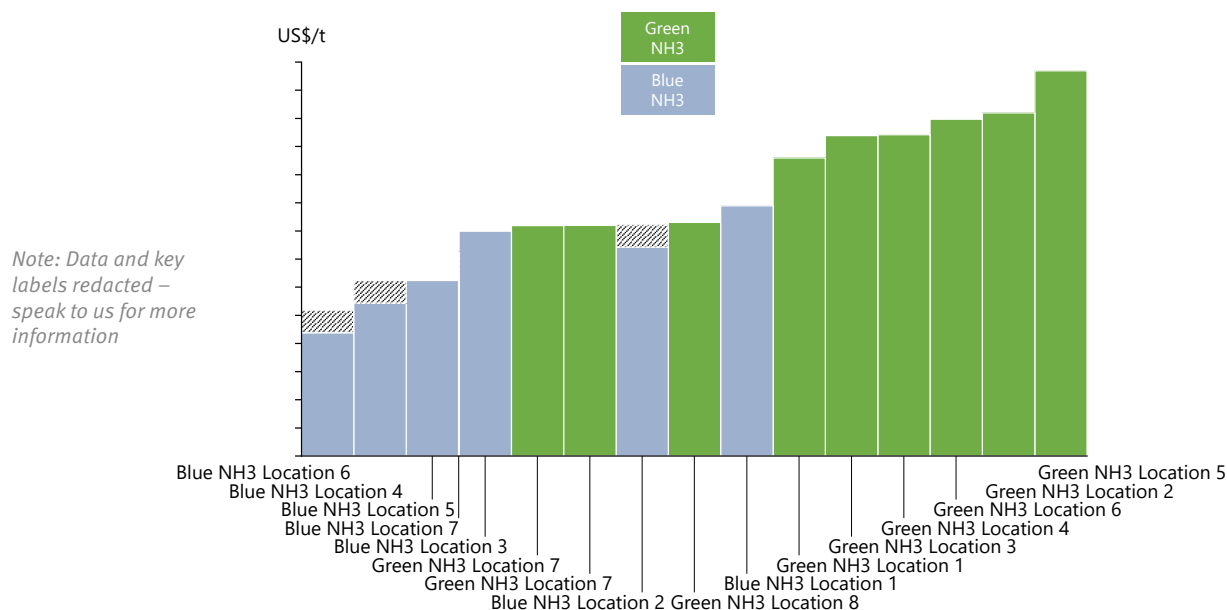
Which countries are best positioned to produce green ammonia and which country and end-use markets are they likely to serve?

What will green and blue ammonia cost to produce and how will these costs change?

## Key features

- Overview of ammonia supply chain (current producers, key end users, logistics)
- Overview of the key macro trends and factors driving decarbonisation and the role and position of alternative fuel carriers
- Demand forecast for the key ammonia as a fuel markets to 2050, taking in to account its potential against competing low or zero carbon fuels, technical considerations, and likely legislative and regulatory interventions
  - » Direct uses
    - » As a bunker marine fuel
    - » For power generation
    - » For conventional uses, like fertilizers and chemicals
  - » Indirect uses
    - » Manufacturing
    - » Power generation
    - » Transport
- Region by region assessment of potential for development of low/zero carbon ammonia capacity, including production costs, competitive position and potential government support
- Development of alternative market scenarios for ammonia as a fuel and as a hydrogen carrier - for supply, demand, trade, cost and pricing scenarios, illustrating the impact of alternative assumptions
- Independent assessment of the factors likely to facilitate or hamper the development of ammonia as a fuel
- Access to the expert consultants behind Argus' long-term market analysis
- This comprehensive strategy report is delivered in PowerPoint format, providing essential graphical and narrative analysis

Green and blue ammonia levelized cost curve - 2030



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## Key benefits



**Understand** the key market and non-market influences driving the development of ammonia as a fuel.



**Discover** which sectors are the most promising for the use of ammonia for fuel, and why.



**Develop** your understanding of the economics of blue and green ammonia production, and how they will evolve in the future.



**Assess** the existing ammonia market, its buyers, suppliers and infrastructure.



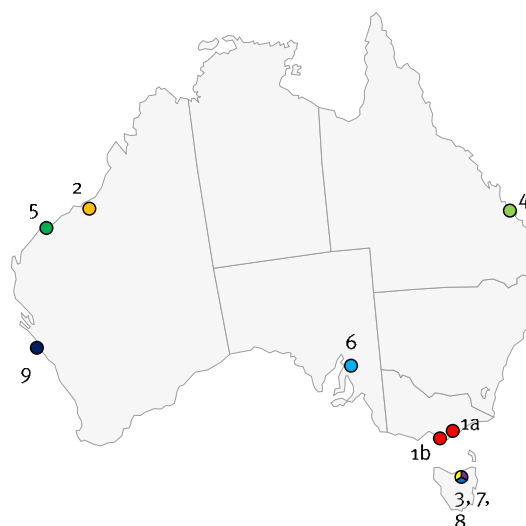
**Quantify** the potential size of the future 'ammonia for fuel' market using robust underlying data developed by Argus' unique multi-commodity, multi-disciplined team.



**Enhance** your strategy to capitalize on this fast-developing market.

### Example of project tracking

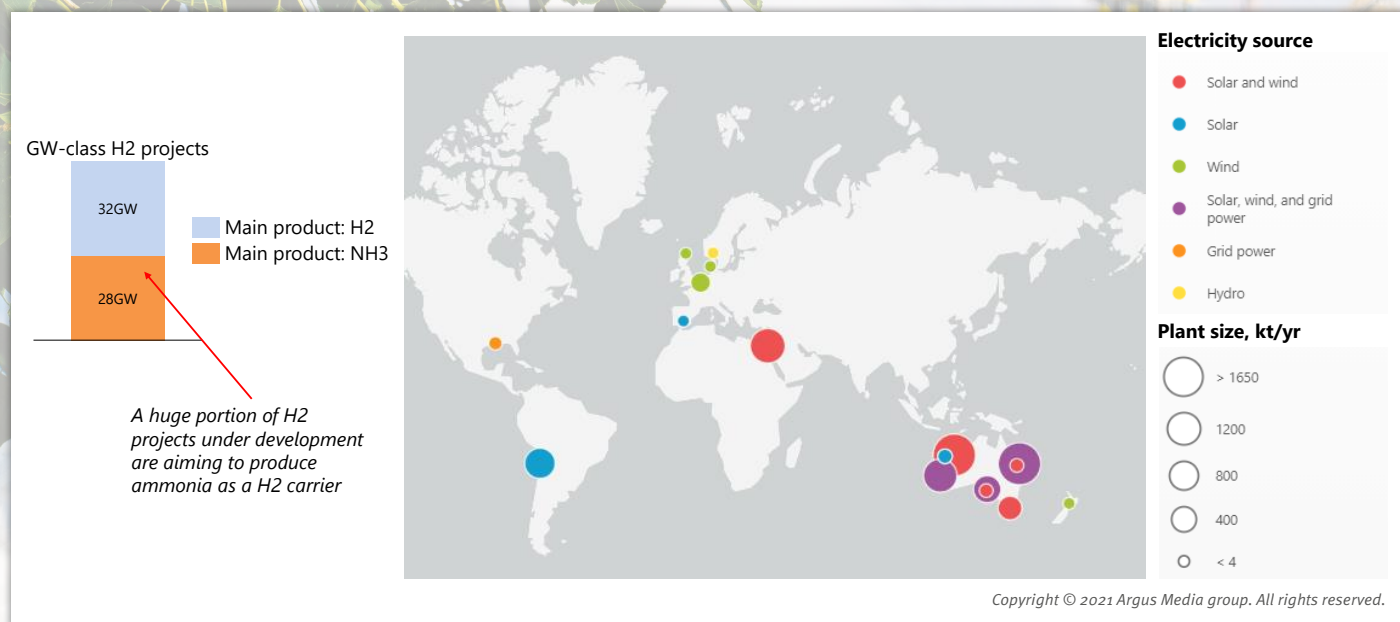
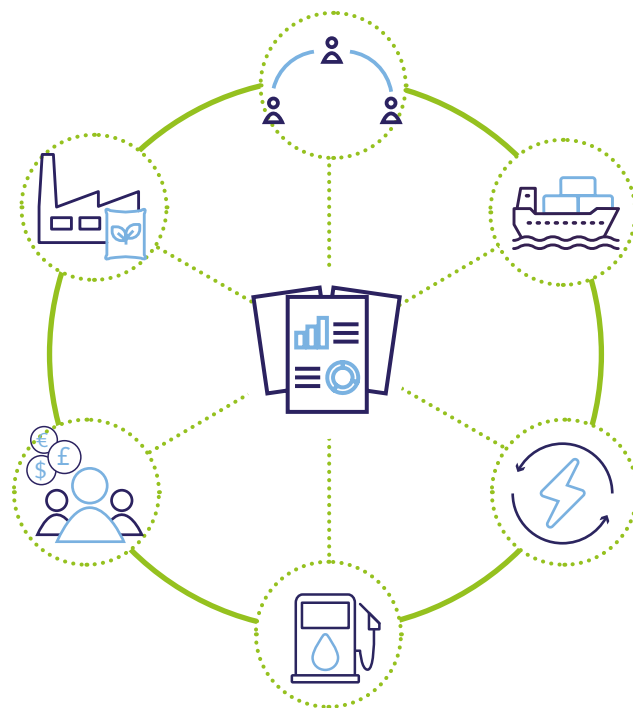
1	Hydrogen Energy Supply Chain Project 1a: Gasification plant, Traralgon, Latrobe City, Victoria 1b: Storage/loading facility, Stony Point, Mornington Peninsula, Victoria
2	Asian Renewable Energy Hub Telfer, East Pilbara, Western Australia
3	Hydro Tasmania Hydrogen Project Bell Bay Advanced Manufacturing Zone Bell Bay, George Town, Tasmania
4	H2-Hub™ Gladstone Project Port of Gladstone Barney Point, Gladstone, Queensland
5	Yara-ENGIE Green Ammonia Yara Pilbara Plant Burrup, City of Karratha, Western Australia
6	Crystal Brook Energy Park Crystal Brook, Port Pirie, South Australia
7	Origin Energy's proposed green hydrogen and green ammonia plant Bell Bay, George Town, Tasmania
8	Fortescue Metals Group's proposed green hydrogen and green ammonia plant Bell Bay, George Town, Tasmania
9	BP green hydrogen and green ammonia project in Geraldton, Western Australia



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## Who should use this report?

- **Fertilizer and chemical producers** seeking to better understand how the development of a market for ammonia as a fuel will impact their business and create new opportunities.
- **Ammonia and energy traders** seeking future opportunities from the energy transition.
- **Shipping companies** that are looking at low/zero-carbon fuel options to comply with IMO directives, and bunker fuels producers and traders that are looking for opportunities in this sector.
- **Power utilities and power generation fuels suppliers** looking to understand potential trends in the adoption of low/zero-carbon fuels in key countries, and the implications for the future fuels mix.
- **Hydrocarbon producers** interested in diversifying their product portfolios in light of increasingly ambitious decarbonization goals.
- **Investors** seeking to gain a better understanding of the opportunities arising from the recent wave of project activity in the hydrogen/ammonia space.



## Table of contents (summarized)

- **Executive Summary**
- **Decarbonisation – Overview of Current Status and Trends**
  - » Current programs, mandates and growth
  - » Current primary carriers
    - » Direct renewable electricity
    - » Biofuels and biomass
    - » Battery power
  - » Trends and momentum in decarbonisation drives
    - » Government regulations and pledges
    - » Corporate and market based initiatives (IOCs, financial institutions)
    - » NGOs, pressure groups and general market awareness
  - » Role of hydrogen in decarbonisation of key sectors
    - » Power
    - » Land based transportation (road, rail)
    - » Long haul transportation (sea, air)
    - » Manufacturing (fertilizer, petrochemicals, iron and steel, others)
- **Introduction to Ammonia (Existing Market)**
  - » Main uses
  - » Schematic overview of existing supply chain
    - » Key producers
    - » Traders and distributors
    - » Shipping and storage
    - » Key buyers
  - » Grey ammonia pricing drivers
- **Green/Blue/Grey Ammonia as an Energy Carrier**
  - » Green ammonia production and supply chain analysis
    - » Overview
    - » Critical technologies and status
- **Demand for Green/Blue Ammonia (Direct and Indirect Uses)**
  - » Marine Bunker fuel
    - » IMO2030 / IMO2050 target overviews
    - » Demand forecast zero emissions fuels
    - » Potential zero emission fuel alternative and current status of green ammonia (comparison of relative technologies such as electricity, biofuels, methanol, hydrogen)
  - » Initiatives in demand side development of green/blue/grey ammonia as bunker fuels
  - » Developing regional demand (Asia, Europe, Middle East, US)
- **Power Generation**
  - » Burning ammonia directly as fuel
  - » Government mandates and incentives
  - » Demand projections
- **Conventional uses (fertilizers and chemicals)**
  - » Recap technology status and price comparison
  - » Potential downstream applications
  - » Government policies, incentive and mandates (e.g. decarbonization policies in agriculture)
  - » Potential development of voluntary premium markets
  - » Projected size of green ammonia market in fertilizers and chemicals (scenario discussion)
  - » Regional demand analysis
- **Indirect uses**
  - » Back cracking technology development and impact on market size
  - » Manufacturing
  - » Power generation
  - » Transport
- **Combined demand side scenarios to 2050**
- **Blue/Green Hydrogen Ammonia Supply Side Developments**

Regional review: Export-oriented green ammonia projects

  - » South America | Oceania | Southeast Asia | Middle East and North Africa | North America | Europe | Russia and the FSU
    - » Government support
    - » Domestic demand to anchor output
    - » Cost structure
    - » Key projects
      - » Stakeholders
      - » Pilot phase sizing
      - » Expansion plans timeline and scaling up
      - » Downstream target application/region
    - » Uncertainties
  - » Supply outlook (2020 – 2050)

## Table of contents (summarized)

### ■ Supply Demand Scenario Analysis

#### Scenario development

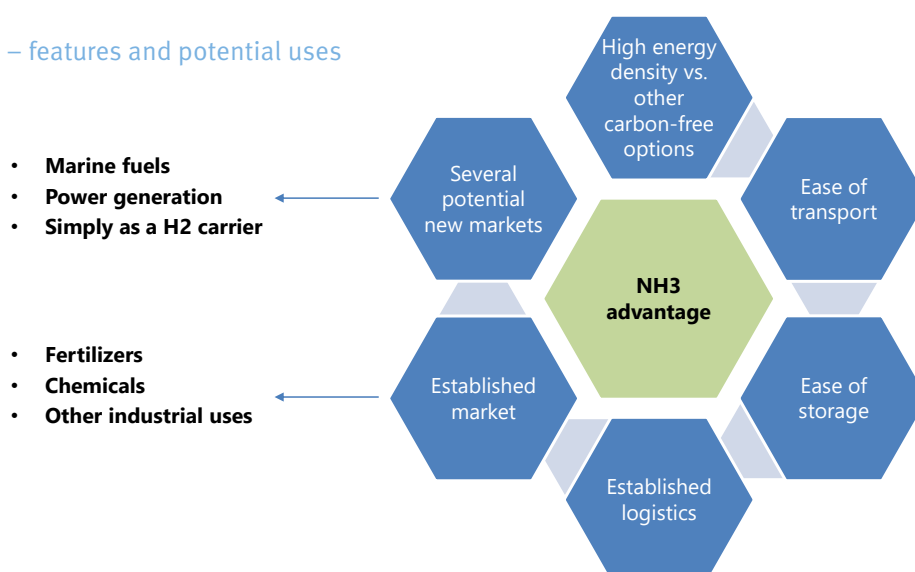
- » High green/blue ammonia demand scenario | Low green/blue ammonia demand scenario
  - » Gap analysis
    - » High green/blue demand scenario: Deficit in supplies of green/blue ammonia vis-à-vis demand
    - » Low green/blue ammonia demand scenario: Surplus of supplies of green/blue ammonia vis-à-vis demand
    - » Implication for trade flows from key exporting regions to import locations
    - » Grey ammonia: Enabling the transition
    - » Barriers to the transition
  - » Cost and pricing scenarios
    - » Potential convergence between grey and blue/green levelized costs (over the 2021-2050)
    - » Qualitative analysis of cost inflation risks in non-fuel ammonia end uses

- » Risks to the development of green/blue ammonia supply chains
- » Infrastructure development costs
  - » Capital costs and project financing
  - » Handling
  - » Storage
  - » Transportation
- » Technology
  - » Maritime sector
  - » Power generation
  - » Cracking of ammonia
- » Alternative hydrogen carriers: Technological progress
- » Other decarbonization options
- » Policy direction
  - » Regulations and certifications
  - » Government support (direct or indirect)

### ■ Concluding Thoughts

- » Potential of green/blue ammonia to enable the hydrogen economy
  - » Ammonia's extant advantages
  - » Key sectors/regions driving demand

### Green ammonia – features and potential uses



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## Our green ammonia expertise

Argus has an established track record of delivering bespoke client studies through our Consulting Services division. We have undertaken a wide range of market studies across a full range of products, including energy, fuels and fertilizer products – with increasing analysis of green ammonia. Project examples include:

CLIENT	TASK	RESULT
<b>Singapore Prime Minister's Office (PMO): Roadmap to decarbonising the economy</b>	The Singapore government's planning division (PMO) commissioned a study to assess the viability of developing a green hydrogen-based supply chain, with focus on applications in power generation and transportation	The potential demand for hydrogen for the economy was examined at the sectoral level. The magnitudes and the entry price levels for each of the sectors was established. Thereafter, the most viable sectors were examined in greater detail, including a detailed cost analysis of the most likely hydrogen carriers, including ammonia.
<b>A major utility company</b>	Ammonia market study – supply and value chain, blue/green ammonia cost analysis	A detailed overview of the global ammonia supply and value chain was provided, with detailed logistics analysis, databases of operating vessels and terminals, as well as an analysis of potential blue/green ammonia levelized costs in all major locations globally. The study included profiles of key players in the ammonia value chain, as well as profiles of major blue/green ammonia projects under development.
<b>A Major engineering company active in oil and gas and petrochemicals</b>	Ammonia market study – technology, industry trends, demand potential for green ammonia	A comprehensive overview of the global ammonia market was provided, including demand, supply and price forecasts, as well as an overview of the current cost structure of the industry. Argus also provided an overview of the potential for the green ammonia market, with analysis of potential uses – both traditional and new applications – industry costs, projects activity and potential incentives.
<b>A major bunker fuel trader</b>	Ammonia industry overview and ammonia logistics analysis, with the aim of supporting internal study of ammonia as a marine fuel	A detailed overview of the global ammonia market was provided, including demand, supply and price forecasts, as well as an overview of the current cost structure of the industry. In addition, Argus provided a comprehensive dataset with key data on over 200 ammonia terminals globally, with information on terminal owners/operators, capacity and port data.

## Benefits of choosing Argus

### Argus experience and expertise in the green ammonia sector

Argus has an established track record of delivering bespoke green ammonia client studies through its Consulting Services division. Argus tracks, reports on and analyses green ammonia market developments and projects in our relevant price reporting, outlook and analytics services. We also produce a range of green ammonia conferences, workshops and webinars.




### Argus multi-commodity expertise

We deliver a wide range of services and market studies across a wide range of commodities, including energy, fuels and fertilizer products. Relevant sectors we cover include ammonia, marine fuels, power, energy transition and more.

### Argus multi-disciplined approach

Our price reporting services provide accurate and reliable daily and weekly price assessments, alongside news and market commentary direct from our expert global editorial team. Our monthly short-term outlooks deliver essential 12-month forecasts for prices and trade balances, while our analytics services connect you with industry-leading analysis of medium-to long term outlooks, price forecasts and cost and supply curves.

Argus' consulting division delivers best-in-class fully bespoke consulting solutions, including market-specific research and analysis. We provide clients with business strategy support; due diligence; customized analysis; research; supply, demand and price forecasts; and strategic market research on local and international fertilizer markets.

Consultancy portfolio	Types of work	Types of clients
Market studies (Market demand, supply or price focused)	<ul style="list-style-type: none"> <li>» Market entry or evaluation</li> <li>» Competitor analysis</li> <li>» Marketing and sales strategy</li> <li>» Sourcing strategy</li> <li>» Supply chain analysis</li> </ul>	 <p><b>Producers and suppliers</b></p> <ul style="list-style-type: none"> <li>■ Fertilizer and chemical producers</li> <li>■ Raw material suppliers, including energy companies</li> <li>■ Cooperatives</li> <li>■ Technology suppliers and engineering companies</li> </ul>  <p><b>Organisations</b></p> <ul style="list-style-type: none"> <li>■ Trade and industry associations</li> <li>■ Government organisations</li> <li>■ International institutions</li> </ul>  <p><b>Financial institutions</b></p> <ul style="list-style-type: none"> <li>■ Buyers and traders</li> <li>■ Investors</li> <li>■ Hedge funds</li> <li>■ Banks</li> </ul>
Marketability (Price focused)	<ul style="list-style-type: none"> <li>» Pricing support</li> <li>» Support for off-take agreement negotiation</li> </ul>	
Project evaluation or financing (Project focused)	<ul style="list-style-type: none"> <li>» Project evaluation for financing/permitting, e.g. (pre-) feasibility/scoping studies</li> </ul>	
Transaction support (Company focused)	<ul style="list-style-type: none"> <li>» Process, procurement or sales improvement</li> <li>» Benchmarking</li> </ul>	
Performance improvement (Operation/company focused)	<ul style="list-style-type: none"> <li>» Process, procurement or sales improvement</li> <li>» Benchmarking</li> </ul>	
Regulatory and policymaking advice	<ul style="list-style-type: none"> <li>» Advice on policy</li> </ul>	
Other types	<ul style="list-style-type: none"> <li>» Litigation</li> <li>» Survey/interview</li> <li>» Event attendance</li> <li>» Expert opinion</li> </ul>	



In times of increased market volatility, it's more essential than ever to have access to accurate, reliable market intelligence founded on robust methodology, produced by the leading experts. Speak to our team to discover how we can support you and your business.

#### More information:

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